

17. A digital magnitude comparator as in claim 15, wherein the comparator compares the magnitude of the instantaneous phase of the reference input signal, reported by the phase digitizer and the instantaneous phase of the accumulator of the numerically controlled oscillator, and wherein the comparator outputs indicate the polarity of the difference between the phases.  
A digital counter as in claim 15, capable of counting up or counting down.
18. A numerically controlled oscillator as in claim 1, wherein two digital inputs are available, one to control the center frequency of the oscillator, and the other to change the frequency in accordance with instructions from the loop filter.
19. A numerically controlled oscillator as in claim 15, further modified to output the instantaneous phase accumulated by the accumulator.

## Abstract

The present invention describes an all digital phase locked loop utilizing a numerically controlled oscillator instead of a voltage controlled oscillator, and in a certain embodiment employs a phase digitizer as part of the phase detector.

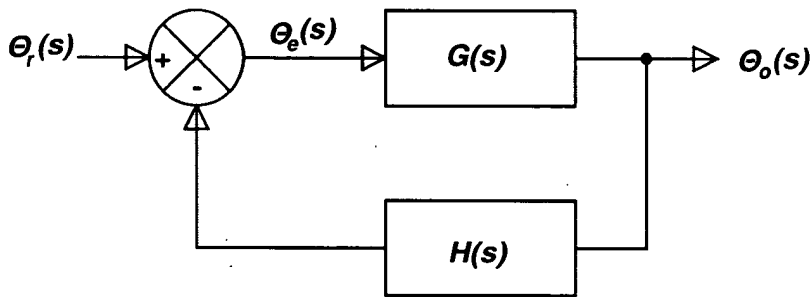


Figure 1, Basic servo loop diagram.

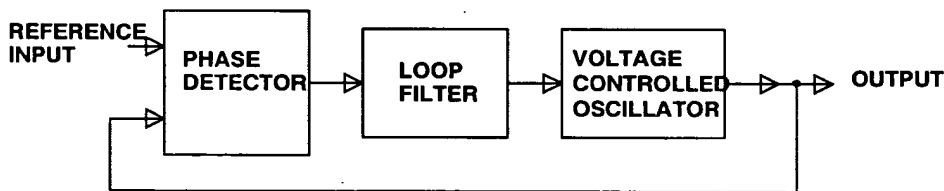


Figure 2, Basic phase locked loop.

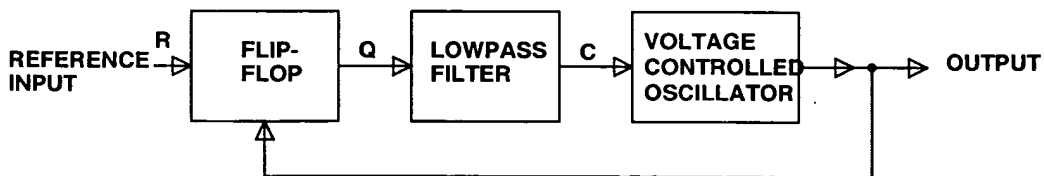


Figure 3, Type 1 PLL.